

Mesozoic and Cenozoic Basins Formation and Deformation Along the North African Margin*

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Abstract

Because there is no evidence of vertical offset of the Moho beneath the Mediterranean arcs, we propose a new model of delamination of the North African continental lithosphere beneath the Central and Eastern Mediterranean arcs, where the ophiolitic sutures of the former Tethyan Ocean are indeed exposed in the hinterland. According to this model, only the infra-continental mantle of Apulia and the Eastern Mediterranean has been and is still locally subducted and recycled in the asthenosphere, the northern portion of the African crust and coeval Moho being currently decoupled from its former, currently delaminated and subducted mantle lithosphere. Late Cretaceous to Paleogene pre-collisional inversions are well documented in the autochthonous foreland in Algeria, Tunisia and deep Ionian offshore, where they predate the development of the overlying Miocene flexural basin. Post-suture transpression also accounts for late inversions of the underthrust foreland in the Southern Apennines, northern Sicily as well as beneath the Tellian allochthon in Algeria, whereas trans-tension and strain-partitioning near the back-stop have locally led to the development of thrust-top pull-apart basins in the Chelif area (Algerian Tell), San'Archangelo Basin (Southern Apennines), as well as on top of the Mediterranean Ridge off the western coast of Peloponnesus.

Recent oil and gas discoveries have been made in the Southern Apennines and Sicily. The knowledge of these various structural styles, source rock distribution and timing of their maturation provide useful analogues for assessing early foreland closures versus late subthrust prospects in the yet under-explored areas of the Algerian foothills, despite the fact that numerous seeps and oil shows have been evidenced, and the exploration risk in the deep Ionian offshore and beneath the Eastern Mediterranean Ridge.

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Mesozoic and Cenozoic basin formation and deformation along the North African Margin

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Introduction

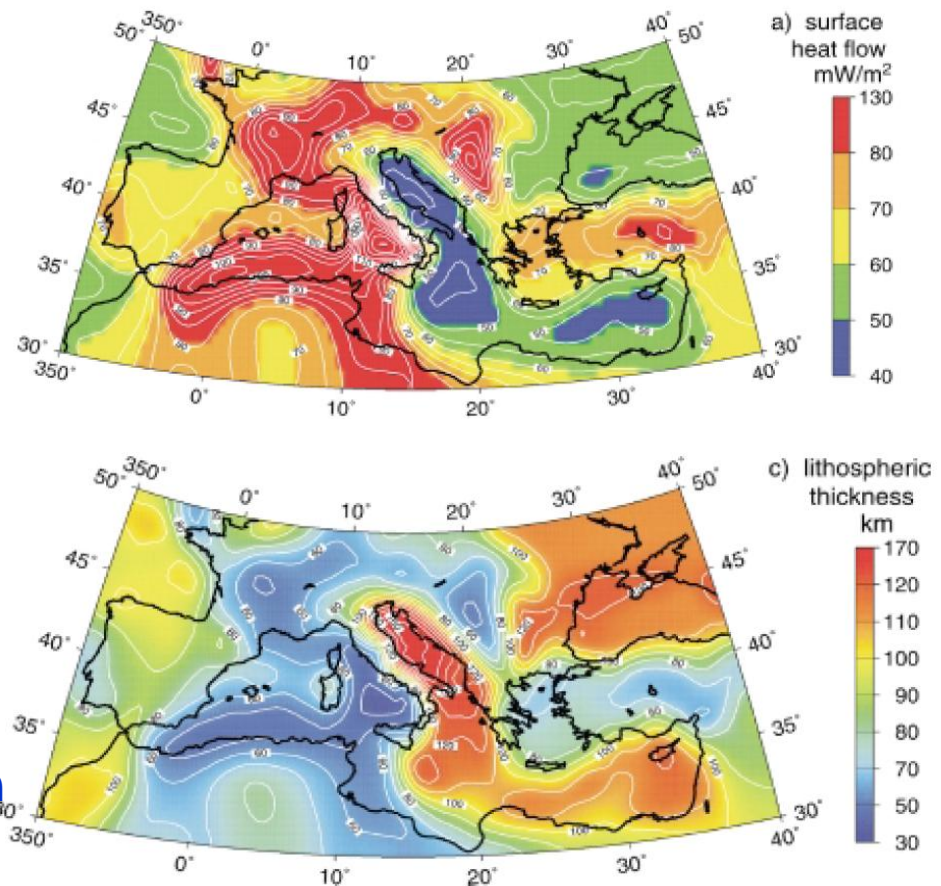
- 1) Ophiolitic sutures, lithosphere thickness and initial geometry of the North African margin
- 2) Modern Mediterranean basins and mantle delamination
- 3) Architecture and petroleum habitats in the Apennines and Sicily
- 4) Architecture and petroleum habitats in Northern Algeria
- 5) Deep Ionian offshore and similarities between the Mediterranean Ridge and the Tellian Atlas

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Ophiolitic sutures, lithosphere thickness and initial geometry of the North African margin

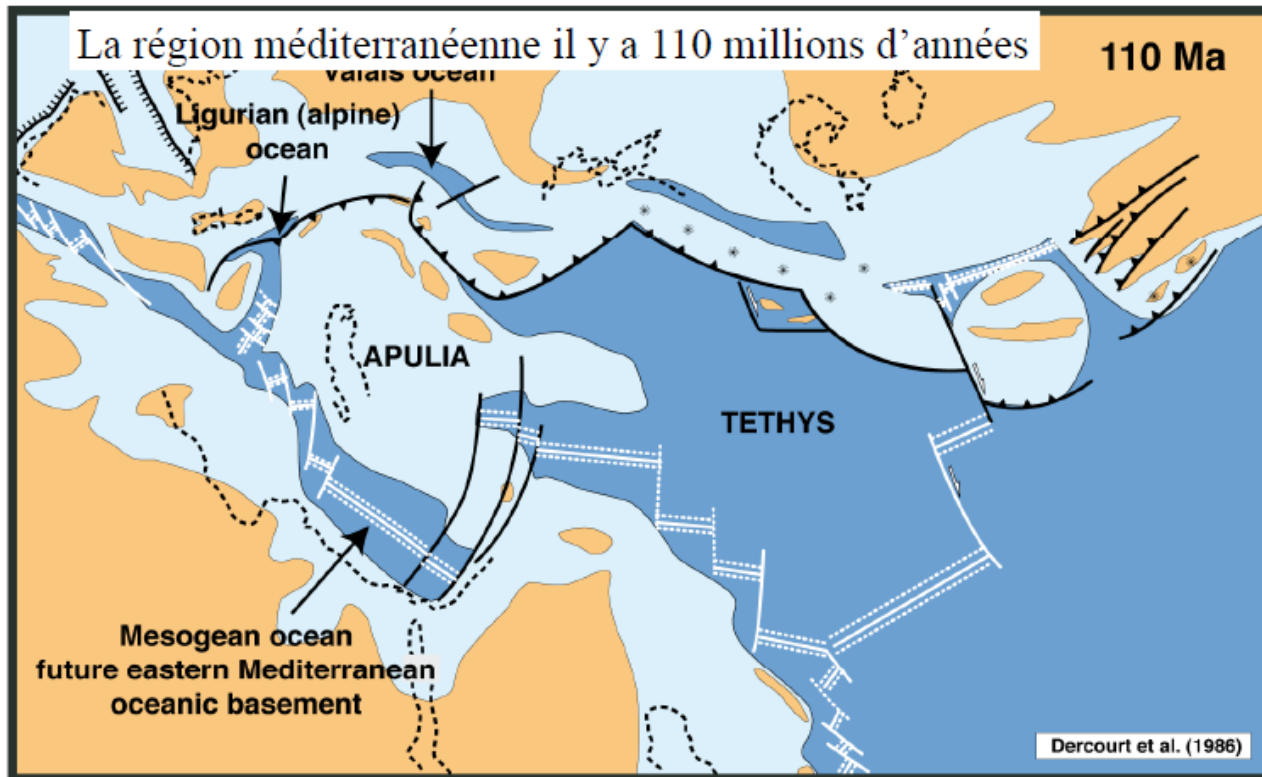
Adriatic domain is characterized by thick, cold and rigid lithosphere



Western Europe and Mediterranean back-arcs have a thin, hot and weak lithosphere

after Jimenez-Munt et al., 2003

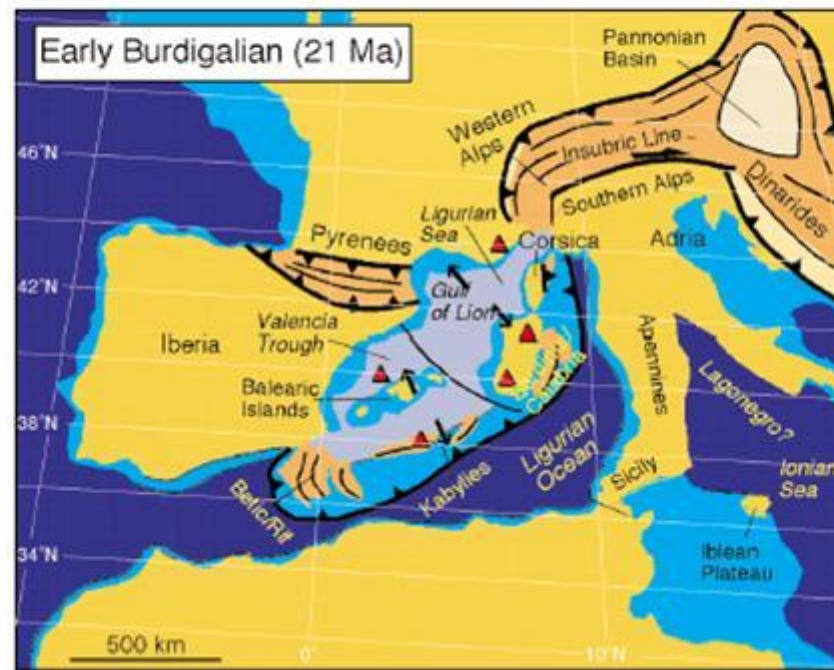
What is the value of palinspastic reconstructions of the Mediterranean Realm?



For instance, where is the evidence for a former Mesogean Ocean between Apulia and North Africa?

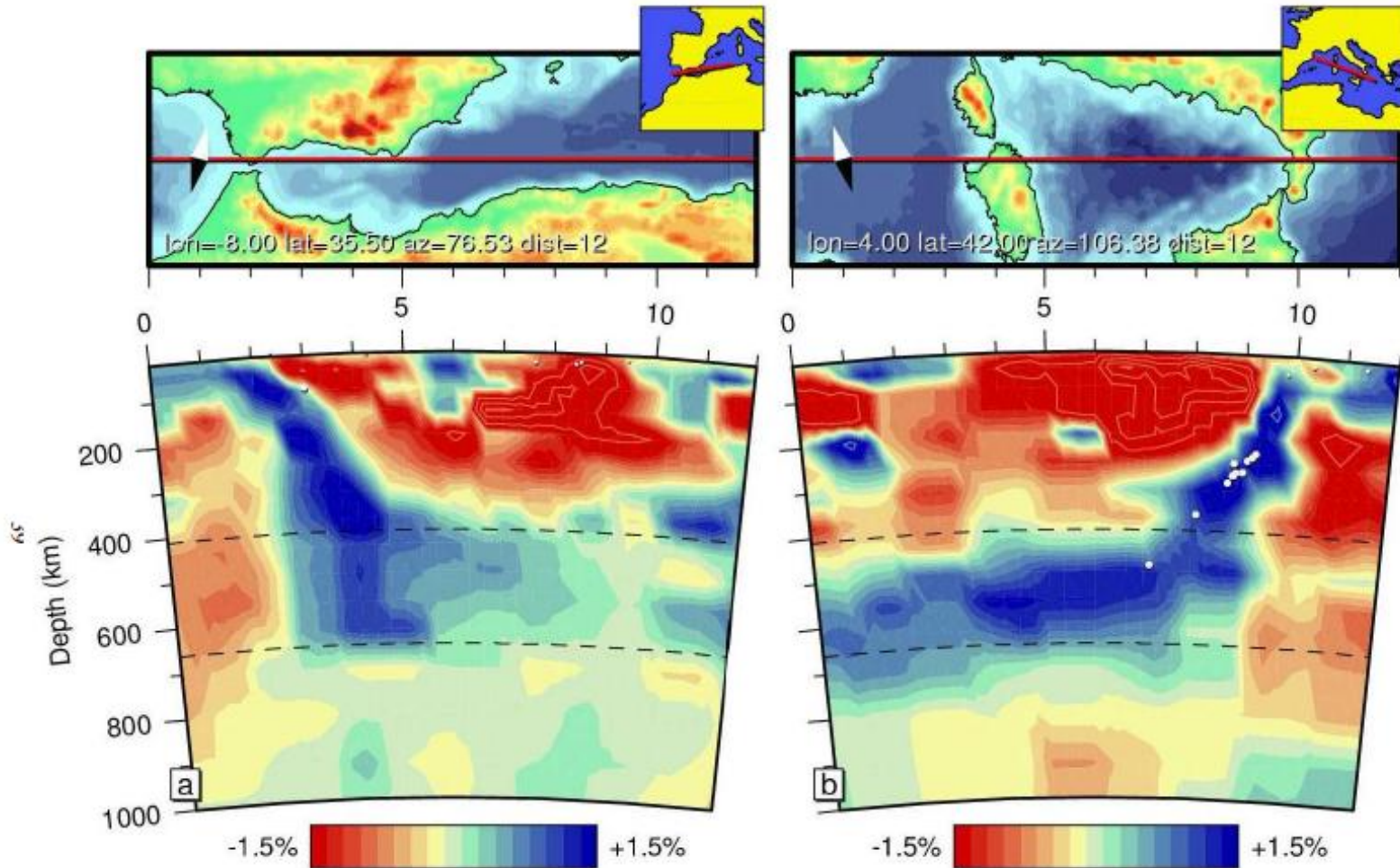
What is the value of palinspastic reconstructions? of the Mediterranean Realm?

From Syn-Rift to Post-Rift Sedimentation

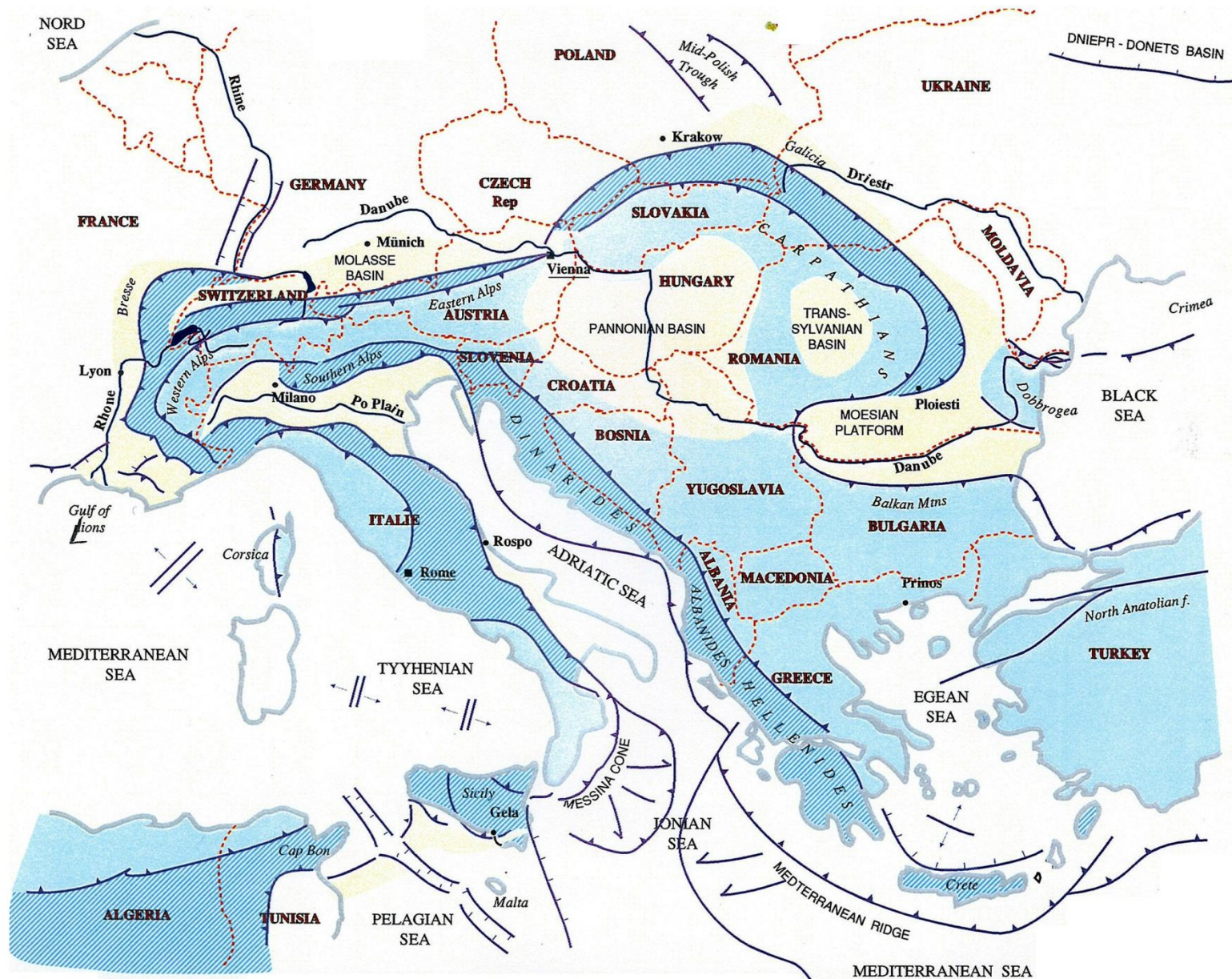


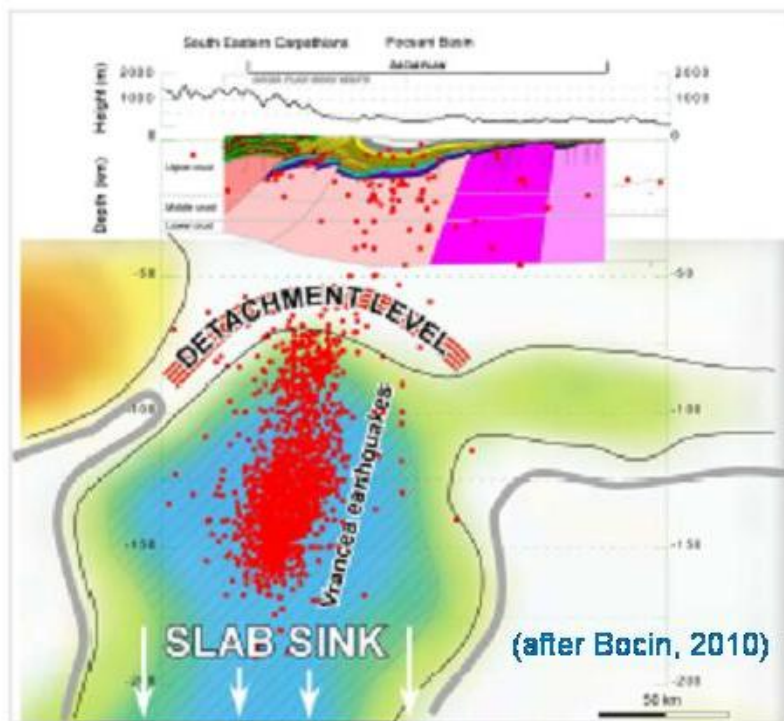
after Rosenbaum et al., 2002

The former Tethyan slab is imaged at 600 km beneath the Western Mediterranean



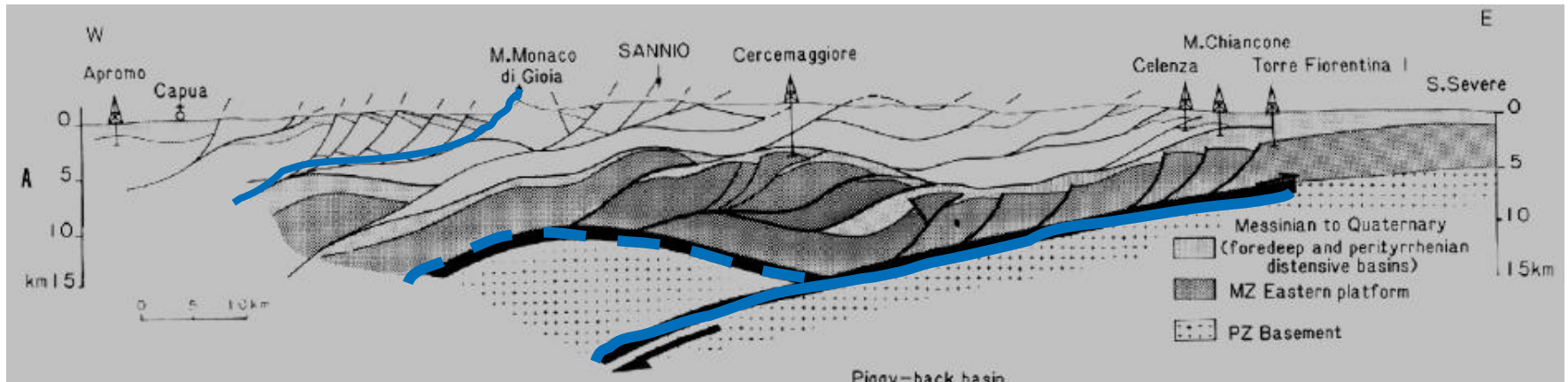
(after TransMed Atlas, Spakman and Wortel)





**Mantle delamination operating below the Moho is obvious
in the Carpathians,
and is likely to occur also beneath the Mediterranean arcs....**

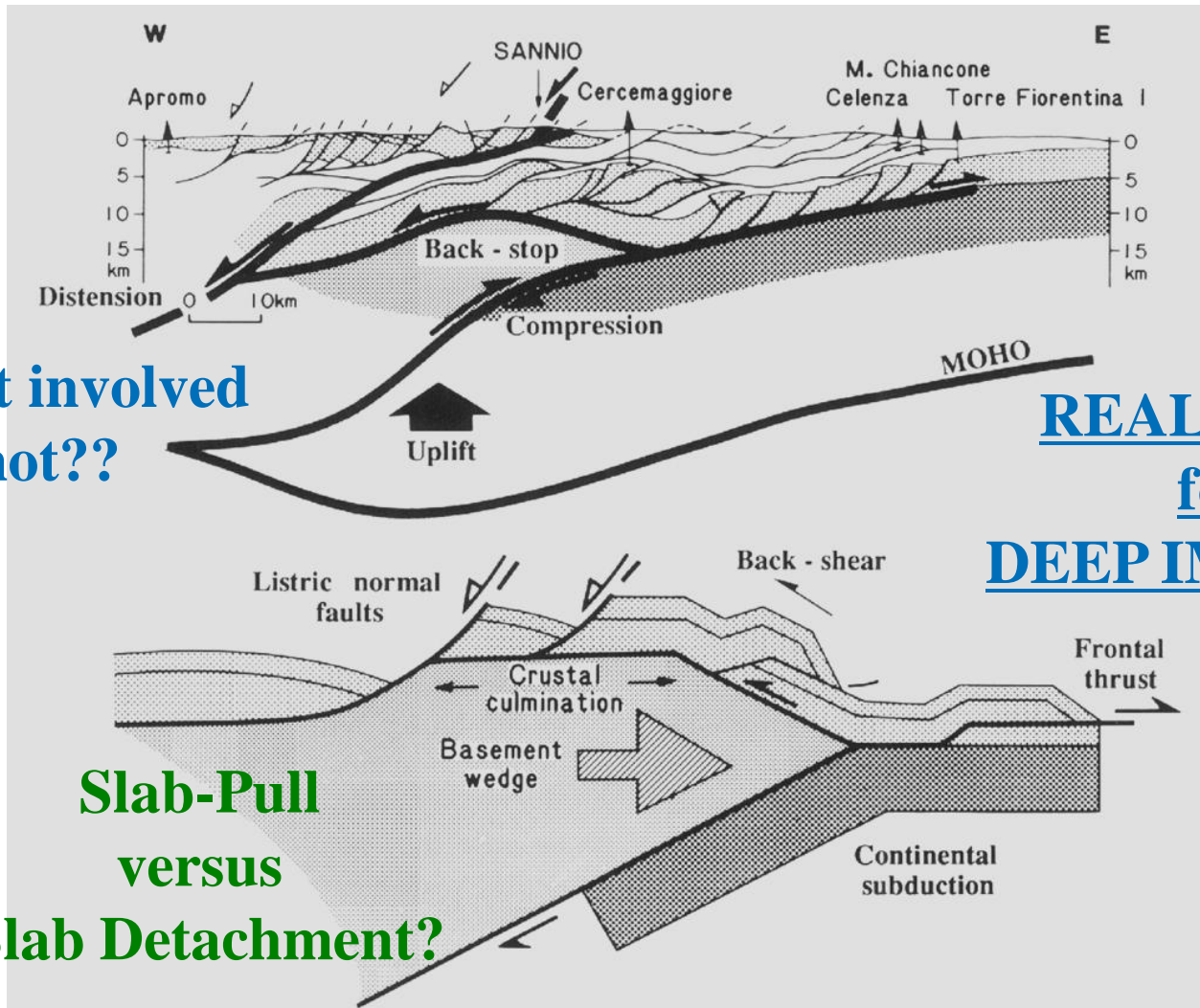
Quaternary Tyrrhenian Extension



Quaternary Uplift
and Unroofing

Pliocene Tectonic Accretion

Roure et al., 1991, EPSL



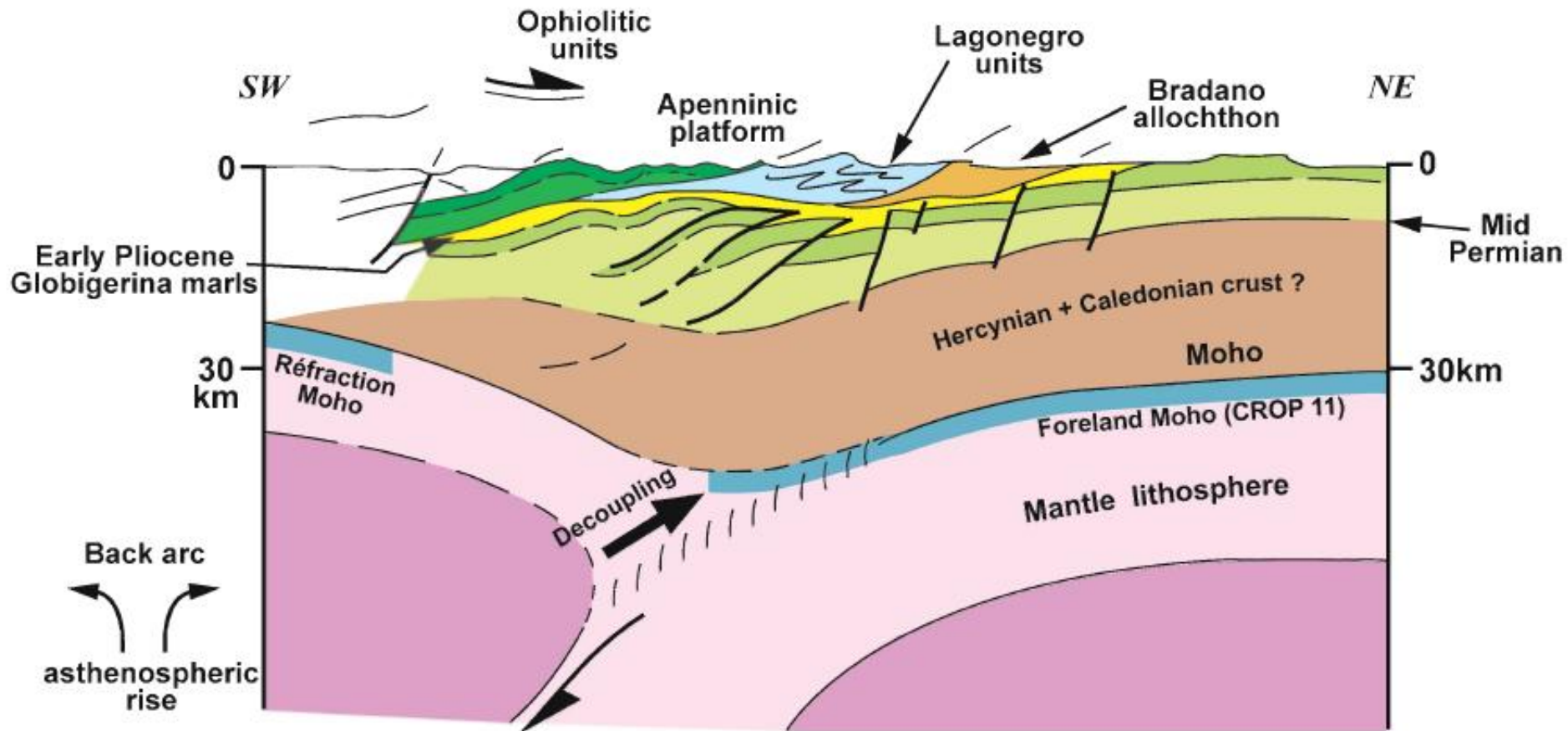
**Basement involved
or not??**

**REAL NEED
for
DEEP IMAGERY**

**Slab-Pull
versus
Slab Detachment?**

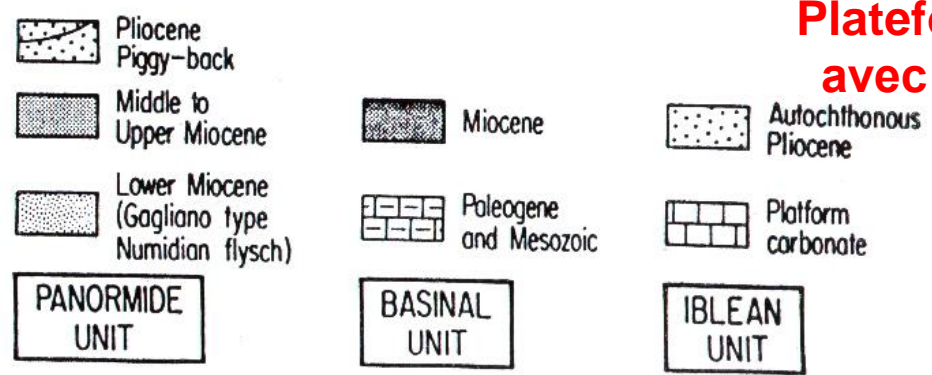
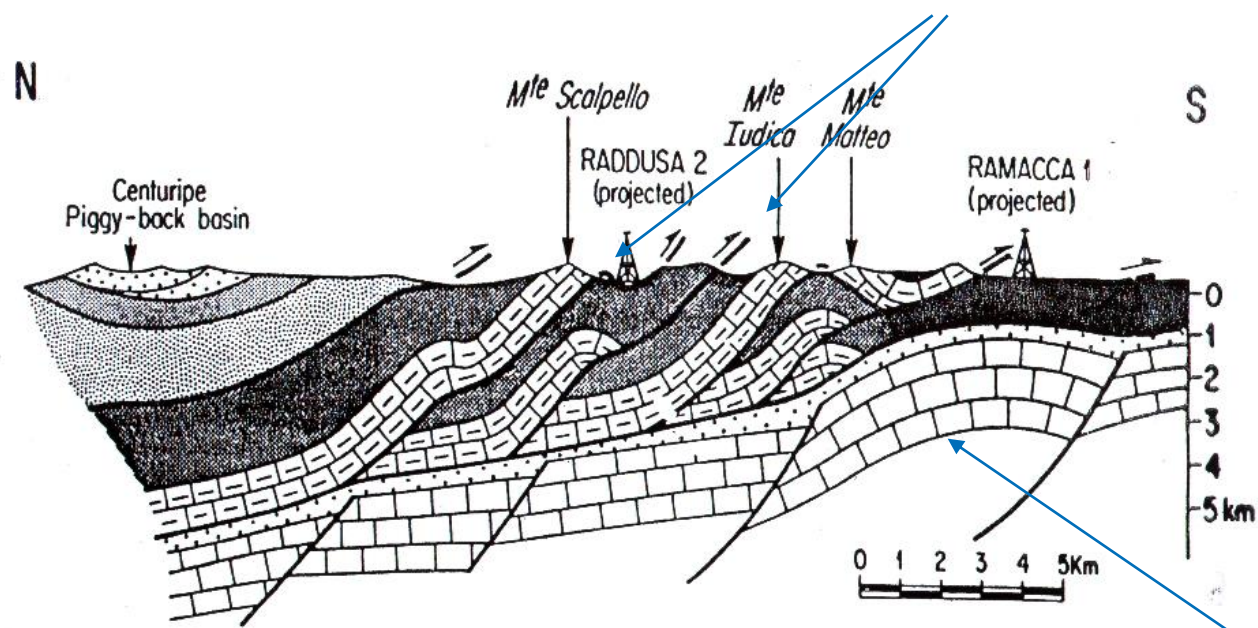
Roure et al., 1991, EPSL

Mantle delamination occurs below the Mediterranean arcs



Roure et al., 2012, Tectonics

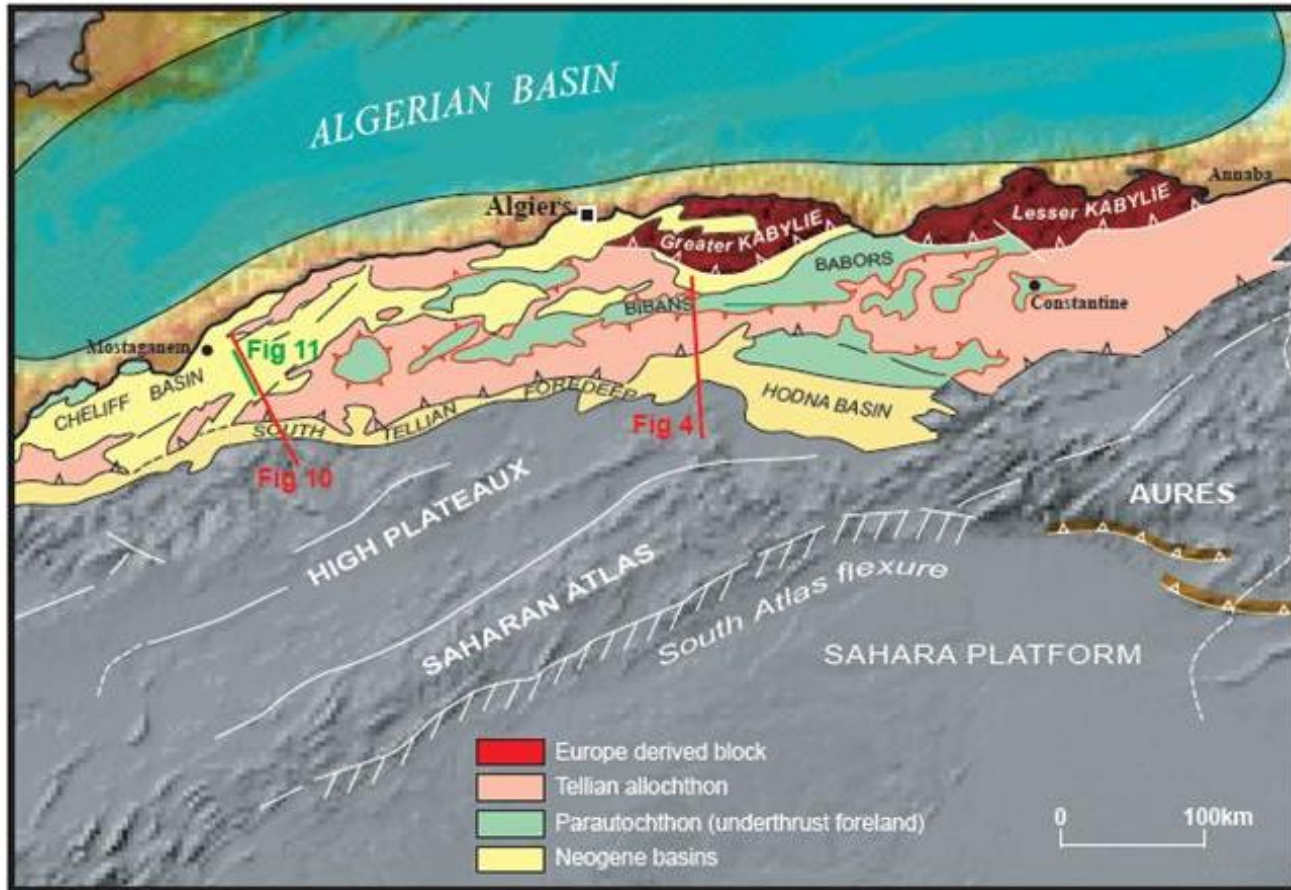
Inclusions fluides à HC dans les ciments des fractures



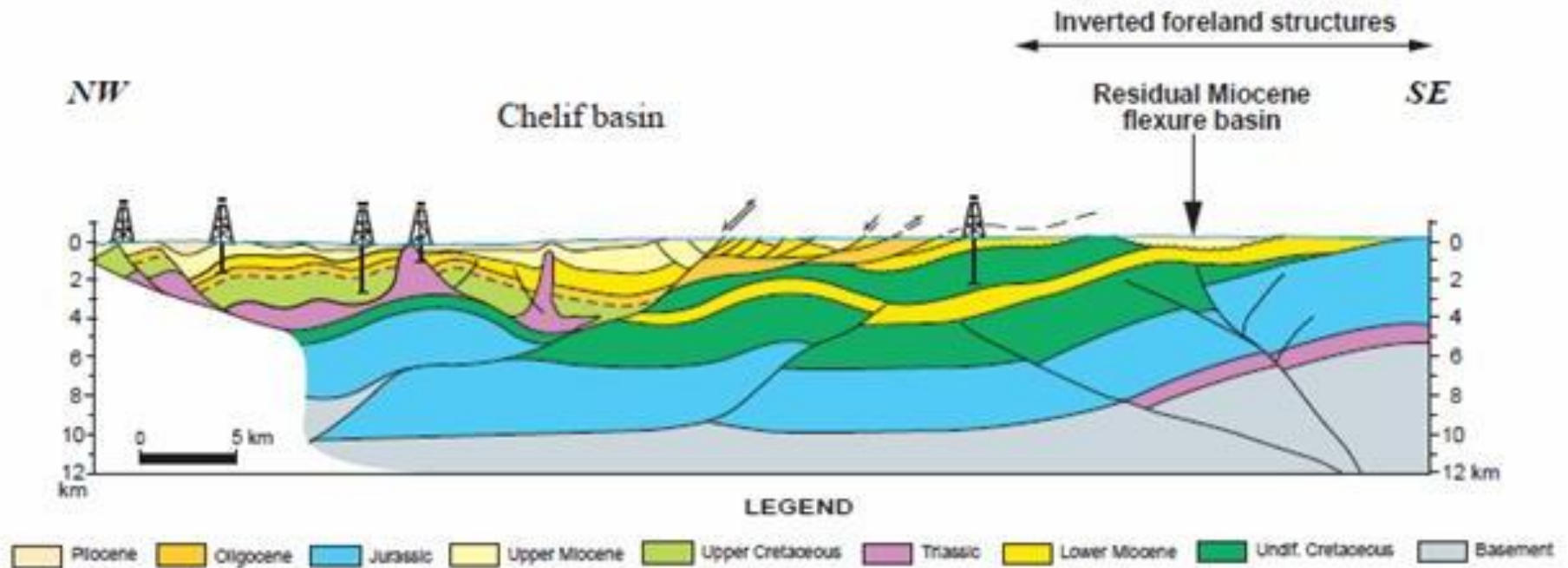
Plateforme sous-charriée avec thèmes Trias-Lias

(after Roure et al.)

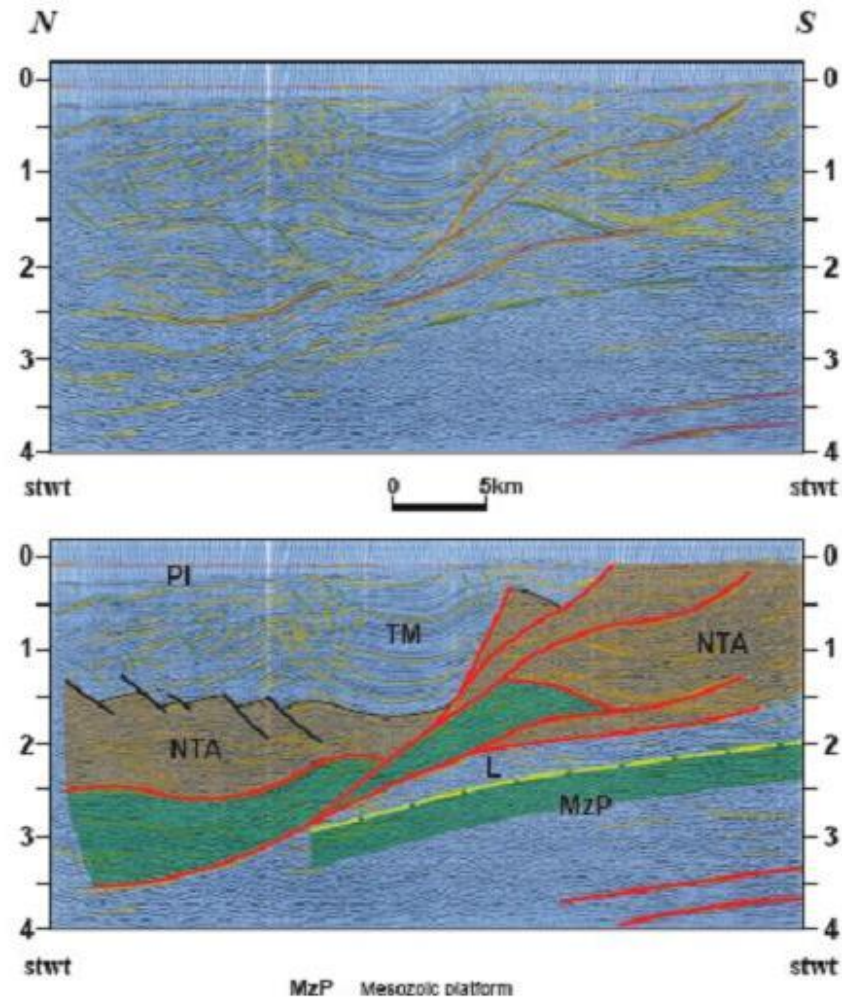
Architecture and petroleum habitats in Northern Algeria



Architecture and petroleum habitats in Northern Algeria



Architecture and petroleum habitats in Northern Algeria



Chélif

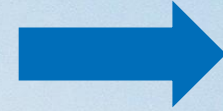


S

N

Post-nappe Miocene series

Transtension



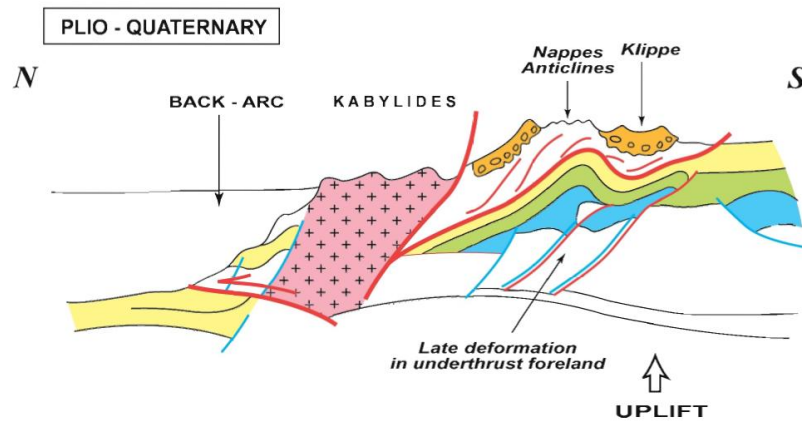
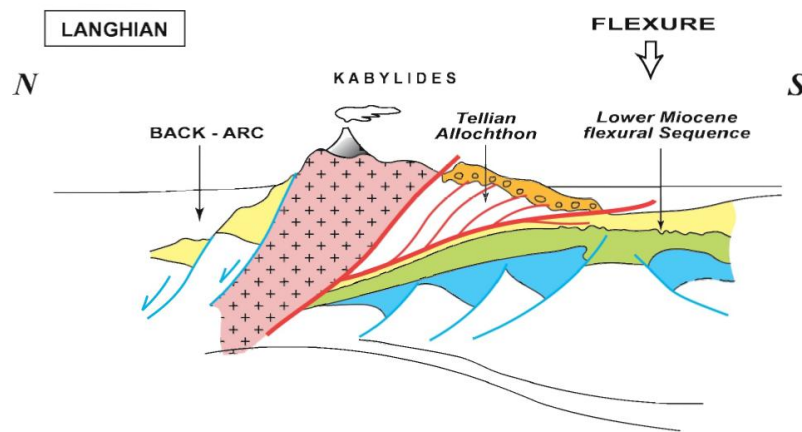
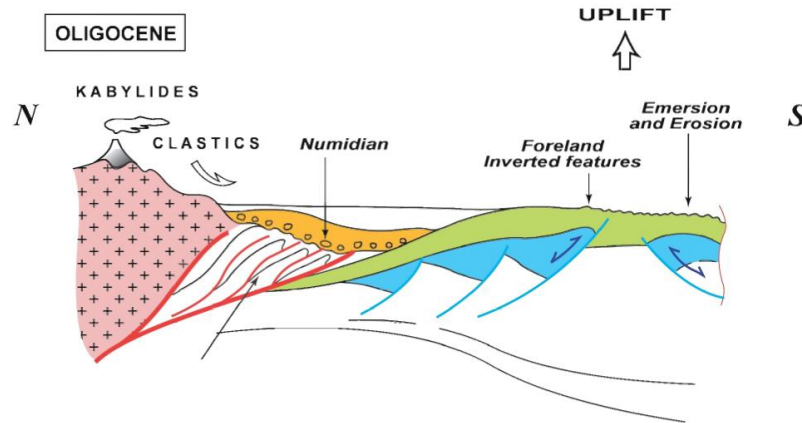
Shallow Younger over Older contact
(outcrops + seismic)

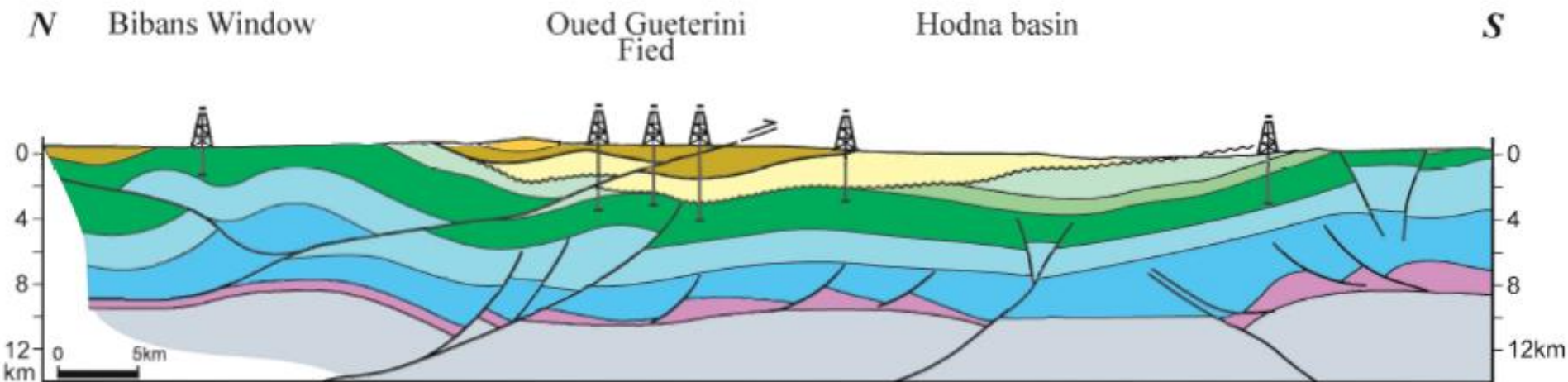
Cretaceous Tellian allochthon

Deep Blind thrust
(seismic)

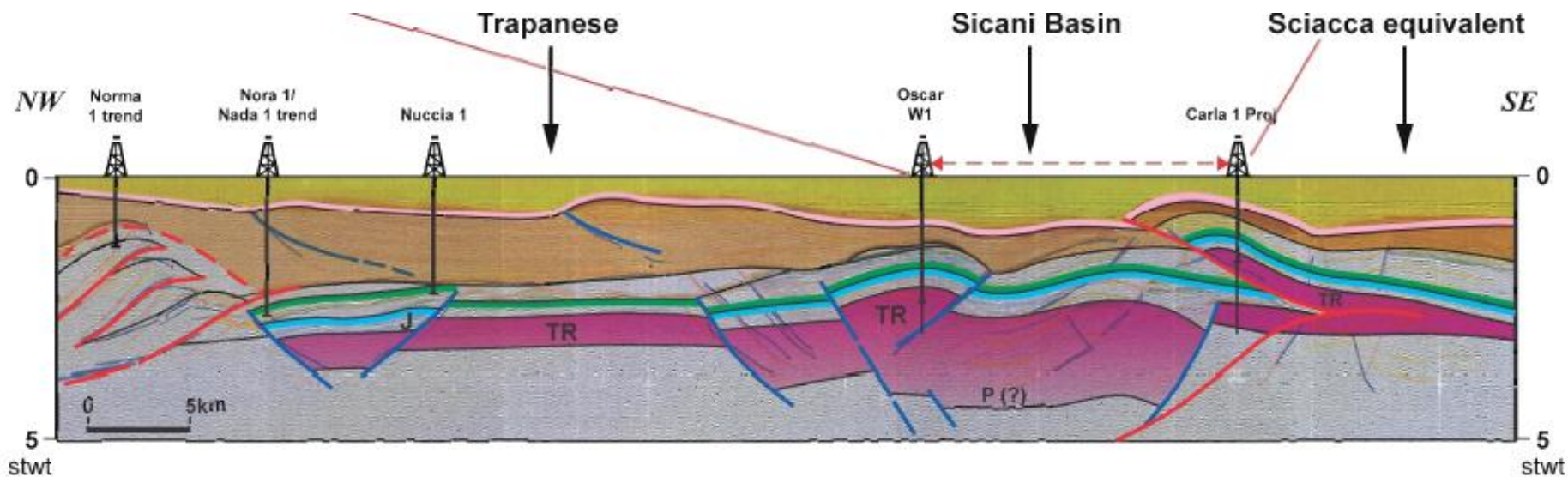
Compression



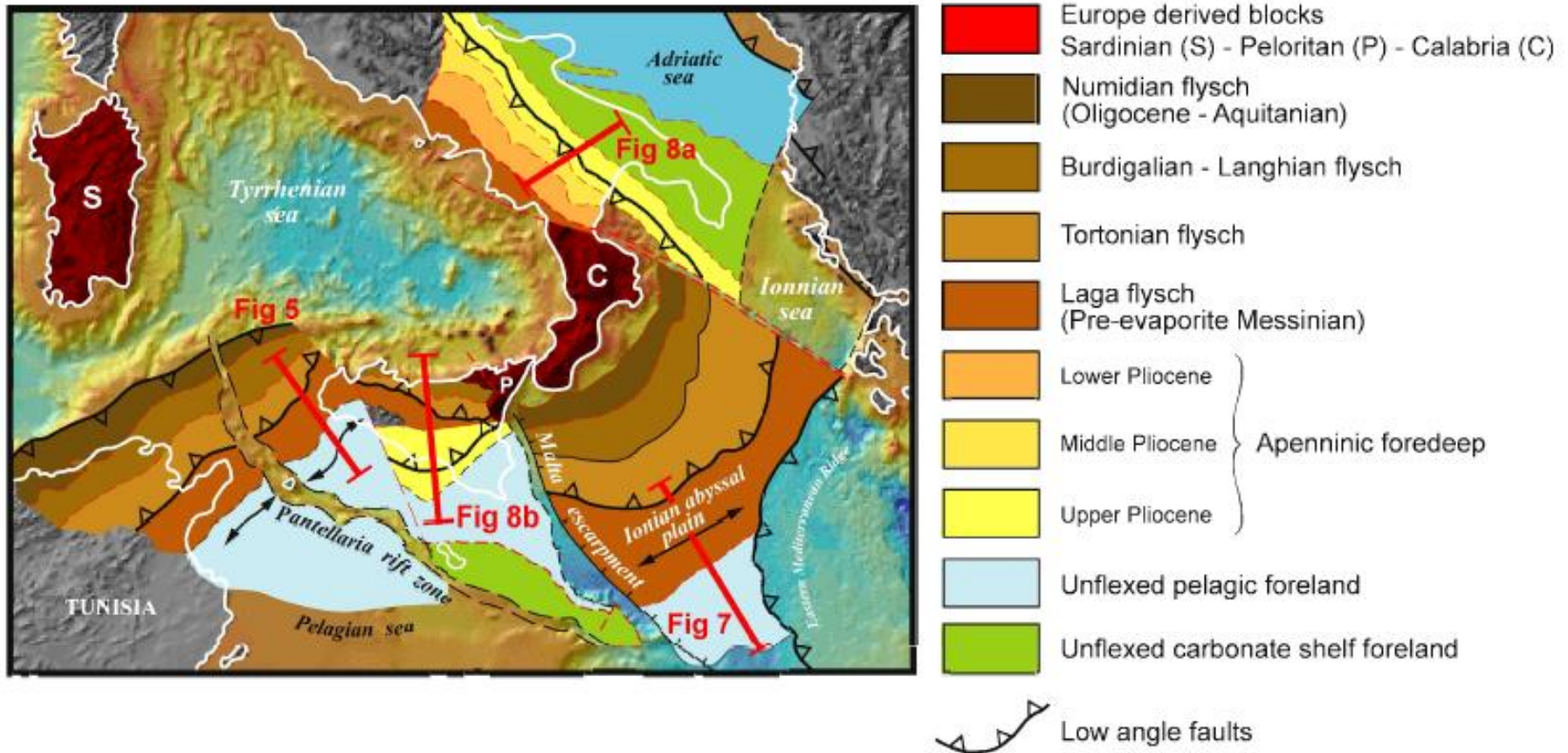




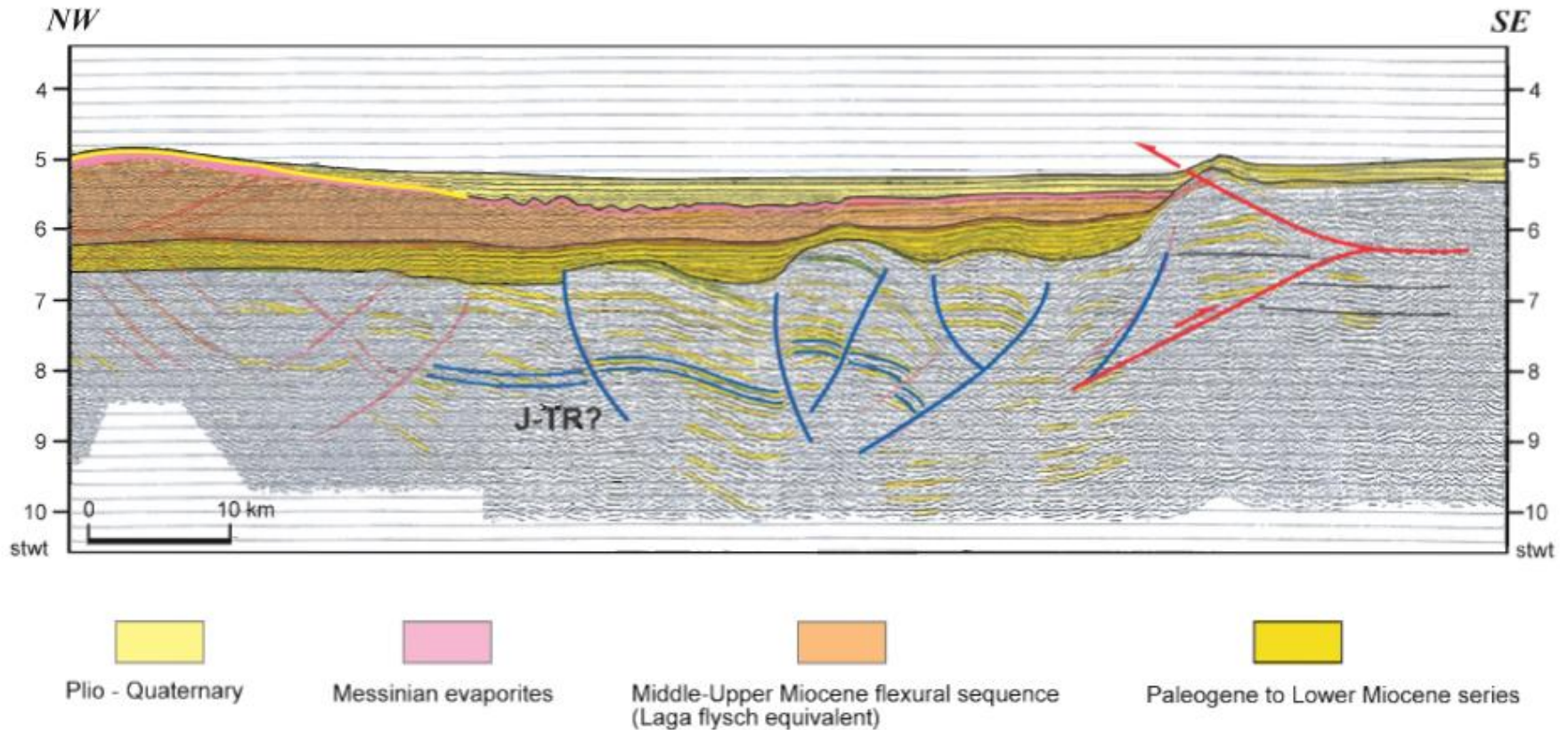
LEGEND



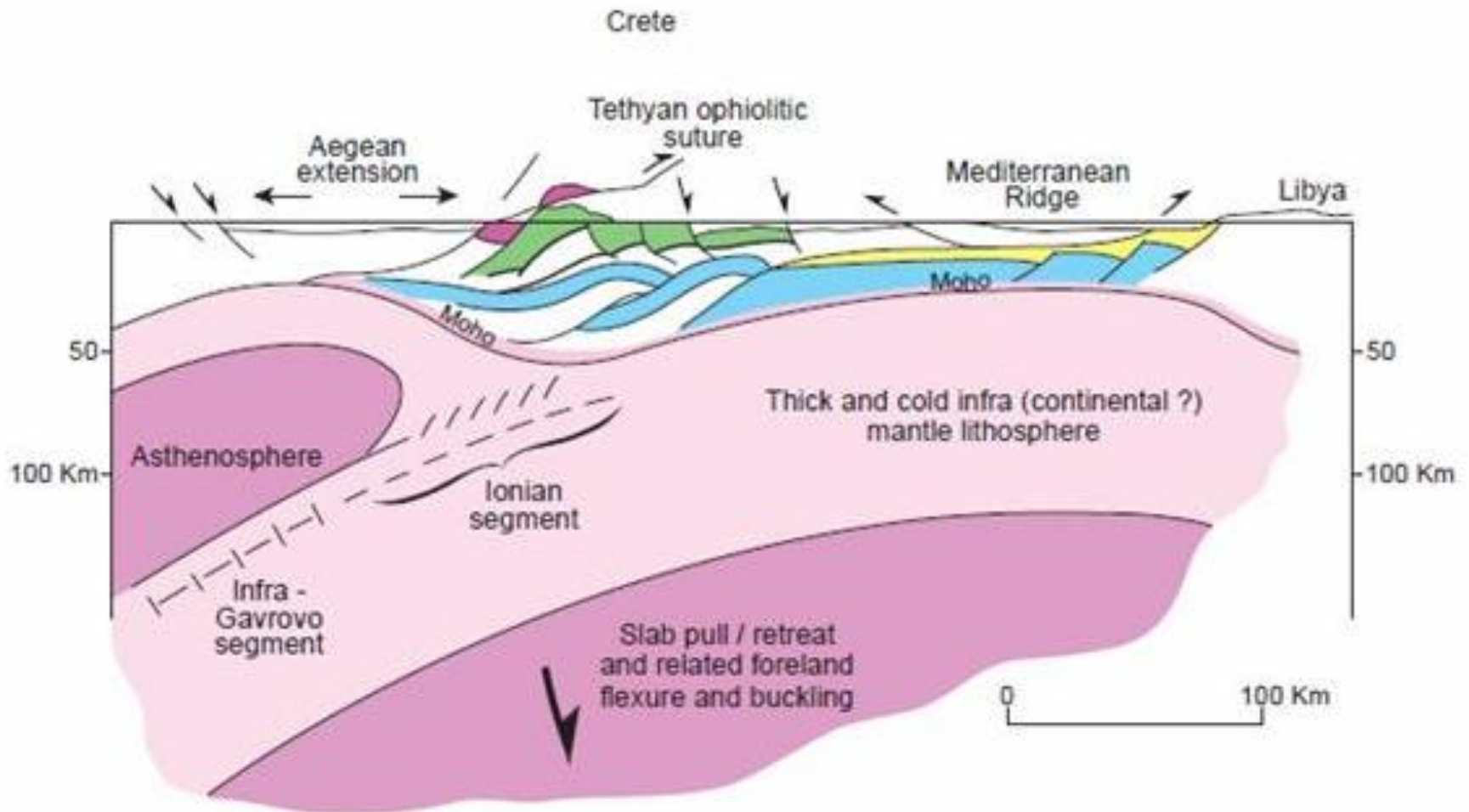
Deep Ionian offshore and similarities between the Mediterranean Ridge and the Tellian Atlas



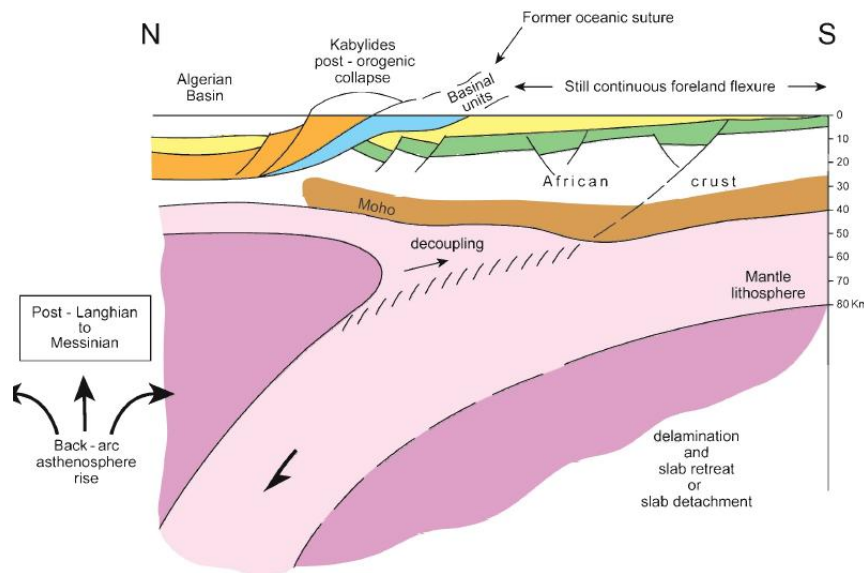
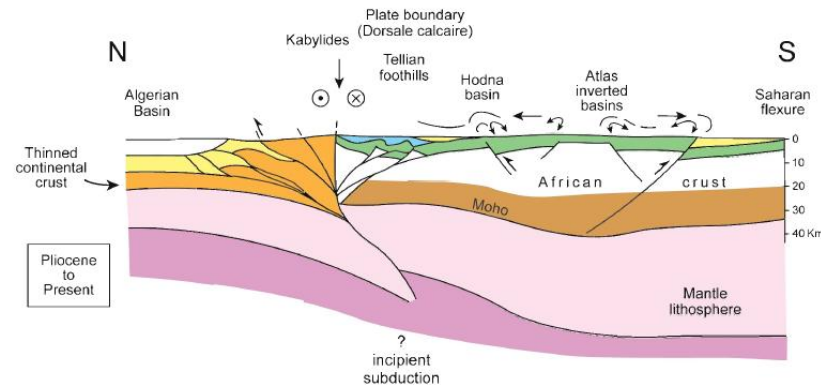
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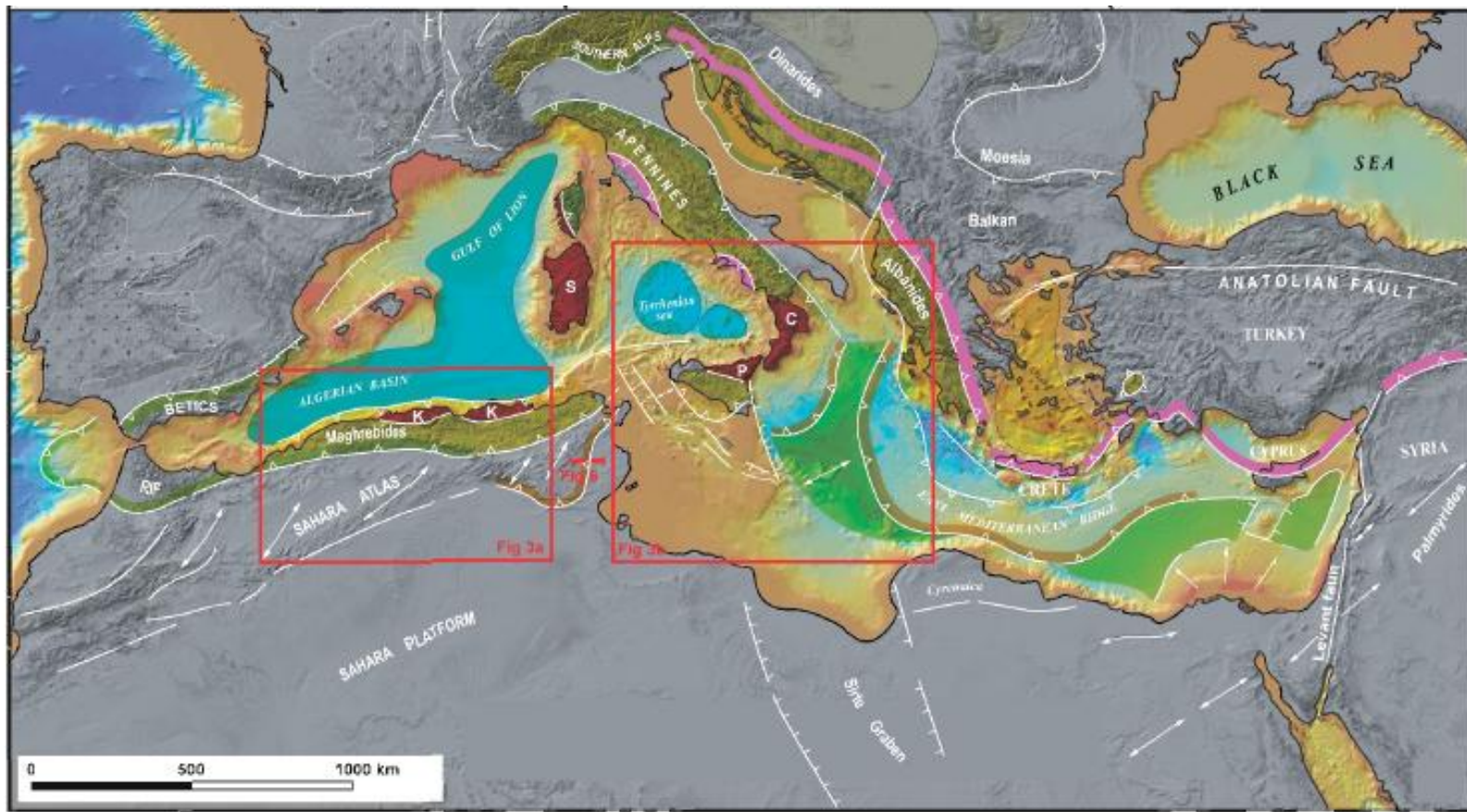


Deep Ionian offshore and similarities between the Mediterranean Ridge and the Tellian Atlas



Deep Ionian offshore and similarities between the Mediterranean Ridge and the Tellian Atlas





Conclusions

- 1) Mantle delamination occurs in Mediterranean Arcs
- 2) The Mesogean Ocean never existed
- 3) The deep Ionian Basin displays the same overall evolution as the Algerian Atlas and Tunisian Chanel
- 4) The Mediterranean Ridge is a good analogue of the Tellian Atlas
- 5) The Apulian Indenter was initially much wider prior to the roll-back of Mediterranean subductions, when African passive margin extended at the current location of the Tyrrhenian and Aegean Basins

Thank you !

